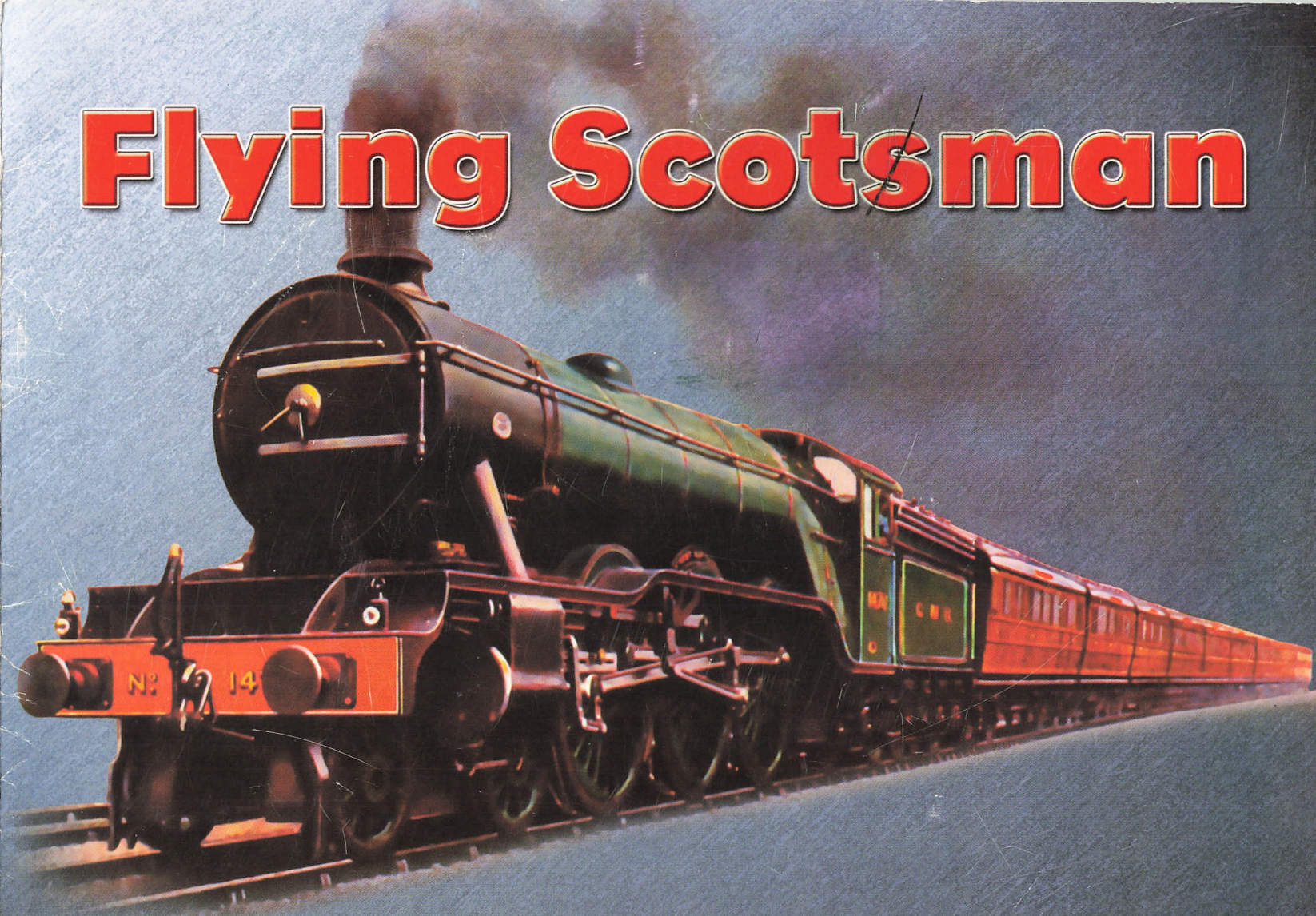


Flying Scotsman



The Flying Scotsman during the age of the AI

The peak for this train was the period between the wars. Leaving King's Cross at 10 o'clock, it completed the 392³/₄ miles to Edinburgh in 5 hours 45 minutes, at an average speed of 69.9 mph, which was exceptional for the time. Consisting of 24 carriages, this outstanding train included, amongst others, a restaurant car with a French Louis XVI supposed decoration, a lounge car complete with hairdresser and individual compartments for ladies travelling alone, a wireless telegraph station that gave the latest stock prices to keep the businessmen busy (whilst the women wasted their time at the hairdresser) or even publishing bulletins with pictures received by belinogramme and giving racing results.

The standard locomotive for this train was the Pacific A1, a brilliant class built in 1922 by Nigel Gresley, the Great Northern Railway Chief Mechanical Engineer. His locomotive was able to haul the train from London to Newcastle in 230 minutes, a 268 mile distance and an average speed of over 69 mph and reaching 108 mph. It is, above all, the streamlined A4 locomotives, first seen in 1935, that made the train famous and one of them (Mallard) beat the world speed record with a speed of 126 mph in 1938.

Cover picture:

The first A1 at the head of an express train, with its teak carriages, in 1922. The locomotive, on the Great Northern Railway at this time, had the number 1740; after 1923, with the grouping act that created the London & North Eastern Railway, the locomotive had the new number of 4470.

The 'Flying Scotsman' leaving the King's Cross Station, London in about 1925. Note the two tenders behind the locomotive. ►



Nigel Gresley's masterpiece

Born in 1876, and after brilliant studies, Nigel Gresley forged a career in the railways as did the elite from the major schools of the time: in fact, the railways were the summit of applied technology and science. He was recruited firstly by the London & North Western Railway, then by the Lancashire and Yorkshire Railway. In 1905, he moved to the prestigious Great Northern Railway, which had the fastest and most comfortable trains of the time. The trains running the

GNR took benefit of a strategically placed railway with the main line to Scotland on the east coast of the United Kingdom. Gresley was appointed director of rolling stock for the network then, in 1911, a great and glorious career was launched as he was appointed to the much sought after post of Chief Mechanical Engineer, the highest grade available, which made him responsible for the design of the railway's locomotives. There he was faced with the task of developing the new racing stable for the company that had a long standing rivalry with the London, Midland & Scottish Railway, this fact obliging them to have locomotives that could pull heavier and heavier trains faster and faster.

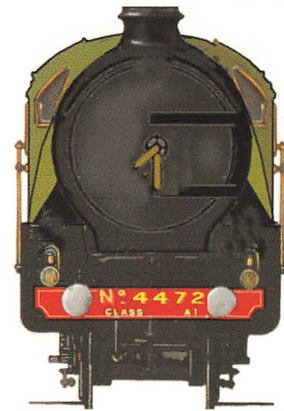
Gresley was already known for the type K2 and K3 of his class 230 locomotives. When he was appointed Chief Mechanical Engineer, he was actually working for the new large company called the London & North Eastern Railway which was the result of merging the Great Northern Railway and other railway companies in 1923 to create a single large company serving all of the north east of England and Scotland. This gave him the chance to go even further with his know-how and his art and to design the first Pacifics for the network, the famous A1, in 1922. These locomotives pulled the company's express services, including the famous 'Flying Scotsman'.

But it was the streamlined A4, that provided the power for the first high speed streamlined English train, the 'Silver Jubilee', and became the fastest locomotive in the world. Gresley, at the summit of his glory, was knighted. He died in 1941 and was fortunate not to have seen the decline of the steam engine.



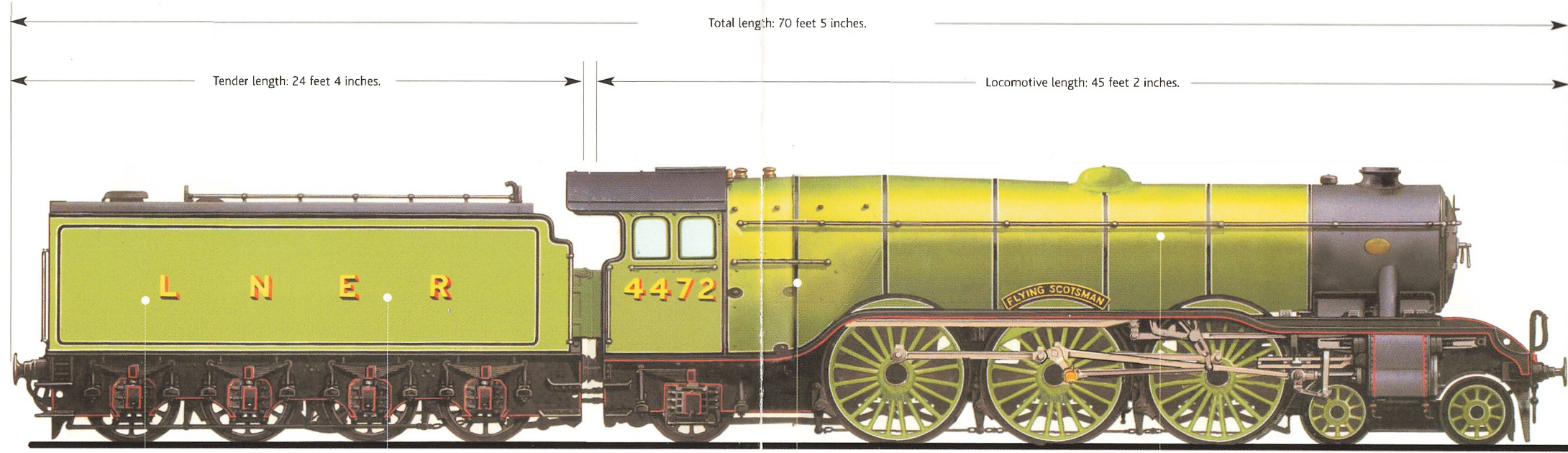
TECHNICAL CHARACTERISTICS OF THE FLYING SCOTSMAN

Locomotive weight: 206,000 pounds.



The Flying Scotsman in numbers

Total length: 70 feet 5 inches.
Total weight: 332,000 pounds.
Maximum speed: 100 miles per hour.
Grate area: 41.25 square feet.
Super heater: 525 square feet.
Boiler steam pressure: 180 pounds per square inch.
Heating surface: 2,930 square feet.
Cylinders: three 20 x 26 inches.
Driving wheels: 80 inches.
Coal: 17,920 pounds.
Water: 5,000 gallons.
Adhesive weight: 34,500 pounds.



Total length: 70 feet 5 inches.

Tender length: 24 feet 4 inches.

Locomotive length: 45 feet 2 inches.

Tender weight: 126,000 pounds.



Tender coal capacity: 17,920 pounds

Tender water capacity: 5,000 gallons.

Bissel wheel diameter: 3 feet 8 inches.

Driving wheel diameter: 6 feet 8 inches.

Bogie free wheel diameter: 3 feet 2 inches.

Total weight: 332,000 pounds.

Boiler heating surface: 2,930 square feet.

Superheating surface: 525 square feet.

The London & North Eastern Railway's Pacific A1

This A1 type locomotive of the London & North Eastern Railway had a name, as was the tradition in the days of steam in the United Kingdom – but not just any name: it was the name of the train it hauled since 1923. At that time, the train, which had already been famous for many years, since 1862, linked London and Edinburgh, travelling up the east coast, leaving King's Cross station in London at 10 o'clock each morning: one of the most famous times in the United Kingdom, which, of course, was respected to the last minute. The late passenger running along the platform is even cheered by the punters who have placed bets on the arrival time at Edinburgh! First put in service in 1922, the famous Pacific A1 locomotives had a task ahead of them to maintain the good reputation of the service: performance and punctuality above all.

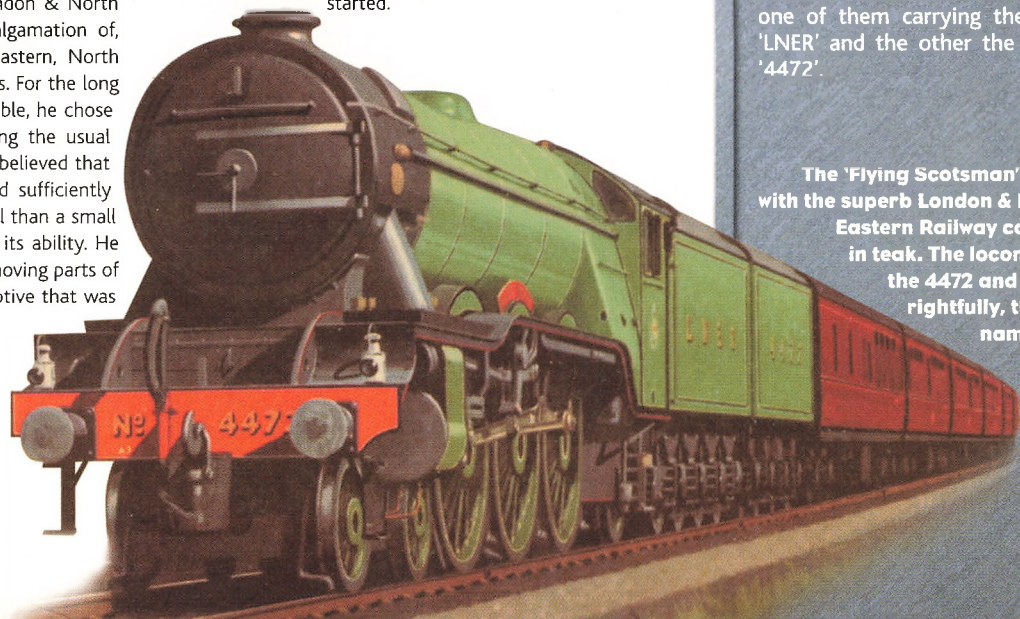
Certainties and uncertainties

Gresley designed the A1 for the brand new London & North Eastern Railway that was created by the amalgamation of, amongst others, the Great Northern, Great Eastern, North Eastern, Great Central and North British Railways. For the long journeys that the new network now made possible, he chose the Pacific wheel arrangement rather than using the usual English preference for small engines because he believed that a big locomotive, which was the right size and sufficiently powerful for the task, would be more economical than a small engine that was always working at the limit of its ability. He was right and from the start took care that the moving parts of his A1 were balanced so as to produce a locomotive that was gentle on the track and rolled freely with ease.

Even children's books enthused about the London & North Eastern Railway's A1 locomotives. Here the locomotive is perfectly drawn with even its two tenders connected to allow passage between them. ➤

Nevertheless, the A1s had weaknesses. Gresley wanted to make a locomotive that was both powerful and simple but the machine, even if very powerful, had problems with controlling this power using a throttle that was too stiff, an 'all or nothing' type according to the English writer Brian Hollingsworth. This meant that too much steam was sent to the cylinders as soon as the driver opened the throttle, even in a very careful action, and this excessive power caused violent skidding. If the driver was able to reduce the steam volume to avoid this skidding, he stood the risk of starting too slowly, then having to regain time.

There was also the over simple conception of the poney truck, without any compensation linkage with the driving wheels. This also caused skidding and loss of traction from a standing start, as too much of the locomotive's weight was on the supporting wheels, unloading the driving wheels at that very moment. The track had to be changed from week to week where the A1s started.



A technical feature for long non-stop journeys

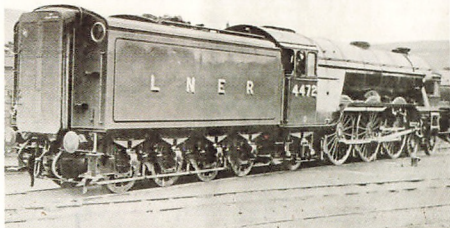
One of the mysteries of the Flying Scotsman was its non-stop journey of 392³/₄ miles. Theoretically it was impossible because every steam train had to stop every 2 or 3 hours during the journey, this for refilling up with water and coal. But in this case, the LNER overcame this problem by attaching two tenders behind the engine, that were fitted with lateral corridors to enable crews to be changed en route from a resting compartment in the first carriage. In general, the two tenders contained enough coal for the trip but at the very tiring cost of transferring it from one tender to the other. The most famous English locomotive, the Pacific No. 4472, travelled with two tenders with one of them carrying the letters 'LNER' and the other the number '4472'.

The 'Flying Scotsman' train with the superb London & North Eastern Railway carriages in teak. The locomotive is the 4472 and carries, rightfully, the same name as the train. ➤

The competition for London - Scotland passengers: in red, the London, Midland & Scottish Railway's route up the west coast and, in green, that of the London & North Eastern Railway on the east coast. The battle had been going on for several decades when the AIs went into service and it was to last for many more years.



A rare rear view of an AI which shows the tender with its corridor to allow the crew change during a journey. The reserve crew travelled in the train's first carriage.



The Flying Scotsman: a legendary train

The London-Edinburgh line was very important in the United Kingdom and it was a main economic and industrial route creating great travel needs. The transport of passengers on this line had attracted the attention of British companies since the 1840's and a merciless duel had lasted over a century between the companies operating the line.

On the one hand there was the London Midland & Scottish Railway, which operated the West Coast Main Line, and, on the other hand, the London & North Eastern Railway, which used the East Coast Main Line,

and both resulted from the 1923 grouping act. Taking up the old positions of the Midland Railway and the Great Northern Railway, from which they had descended, the two companies virtually declared war on each other.

The LMSR with its splendid bright red trains with yellow lining compensated for their slower journey time by providing greater comfort whilst the LNER had inherited the excellent East Coast Main Line and express train know-how. The LMSR had certainly tried by successively introducing trains with names that were more appealing to the British ear such as Coronation Scot but all was to no avail. As far as most of the British public were concerned, the only real trains that mattered, were those of the LNER.



What is really called the Flying Scotsman?

It is, of course, the London to Edinburgh train. But in the United Kingdom, there was a practice of giving names to steam engines and, to further complicate things, one of the A1s that hauled the service was given the same name as the train: it was the No. 4472. As a result, we can see in the duty rosters that the Flying Scotsman is scheduled to haul the Flying Scotsman! Other locomotives of the same type hauled the train and had different names, particularly the famous 'Papyrus', which averaged a speed of 69 mph on the line in 1932, or the 'Salmon Trout', which was the last of the type in service up until 1965.

From the A1 to the A3 and A4

The prestigious type A1 designed by Gresley was not without further development. Compared to the 1922 A1, the type A3, first produced in 1926, was more powerful and heavier; from then on, the Flying Scotsman had 23 carriages. The type A4 was an evolution of the A3 and entered service in 1935. This version was perfect. The company decided to streamline 4 of its A4s to put them at the head of its articulated and streamlined train, the 'Silver Jubilee', which entered service on 28th March 1935. The success of this silver coloured train was enormous: it travelled between London and Newcastle at the mythic speed of 100 miles per hour. The LNER built 31 other A4 locomotives between 1936 and 1938 and one of them, the Mallard, reached 126 mph under the control of driver Duddington. This speed has never been equalled in the history of steam locomotion.